M14 ENHANCED BATTLE RIFLE (EBR), 7.62MM SUPPLEMENT TO TM 9-1005-223-10

1 December 2008

The M14 EBR-RI was developed in response to the large number of Operational Needs Statements (ONS) submitted for M14 rifles to support the role of Squad Designated Marksman (SDM). The first M14 rifles were fielded to units as they came out of the Depot, equipped with only one magazine and no provisions for optics.

To meet the needs of the SDM program, TACOM-RI selected key components to assemble a package of standardized components to enhance the stock M14 weapon system and provide standardized optics and rails for the mounting of lasers and night vision equipment. To that package was added a Harris Bipod, Sage forward pistol grip, 6 magazines, sling, cleaning kit and laser filter / anti-reflection device.

The M14 EBR-RI is a rack stock M14 rifle that has been mated to the Sage International EBR aluminum billet stock system. This stock system in conjunction with the Leupold precision optics and Sage Internationals Cantilever Mount makes the M14 EBR-RI capable of shooting less than one minute of angle (MOA) in most cases. One MOA is defined as one inch at 100 yds or 10 inches at 1000 yds.

The M14 EBR-RI is built and tested at Rock Island Arsenal by the team that developed it. Each rifle is shot to verify grouping and accuracy and that target is included in the package.

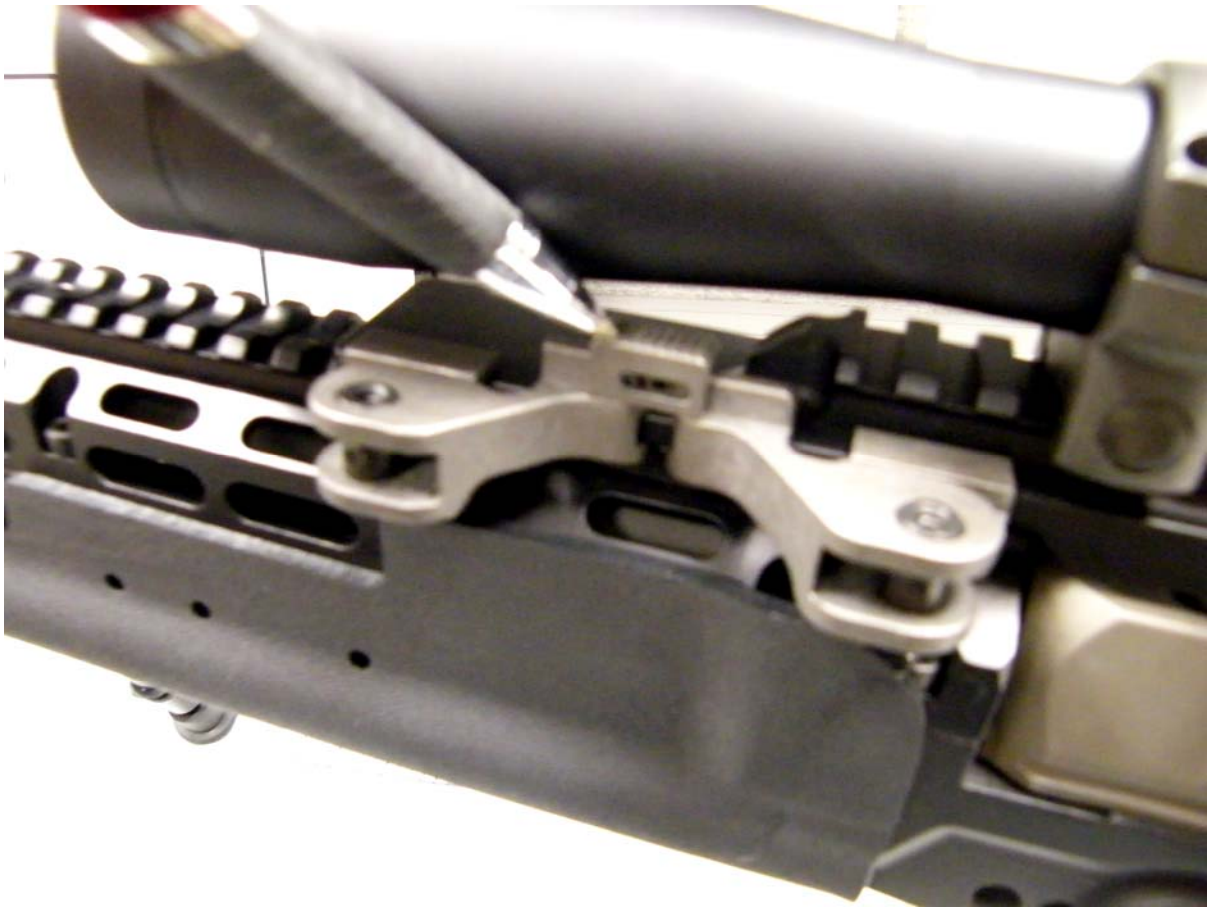
On receipt of the weapon, the scope has been removed and packed in its original box. To install the scope, remove from the box. Using a ½ inch wrench, mount the scope to the installed cantilever mount as shown below:

CAUTION

Removal of the scope is the reverse of installing it. **DO NOT REMOVE** the cantilever base from the rifle to remove the scope.

Removal of the cantilever base should only be done in the event of failure of the optics during battle. Removal of the scope base by using the throw levers will allow use of the standard iron sights.

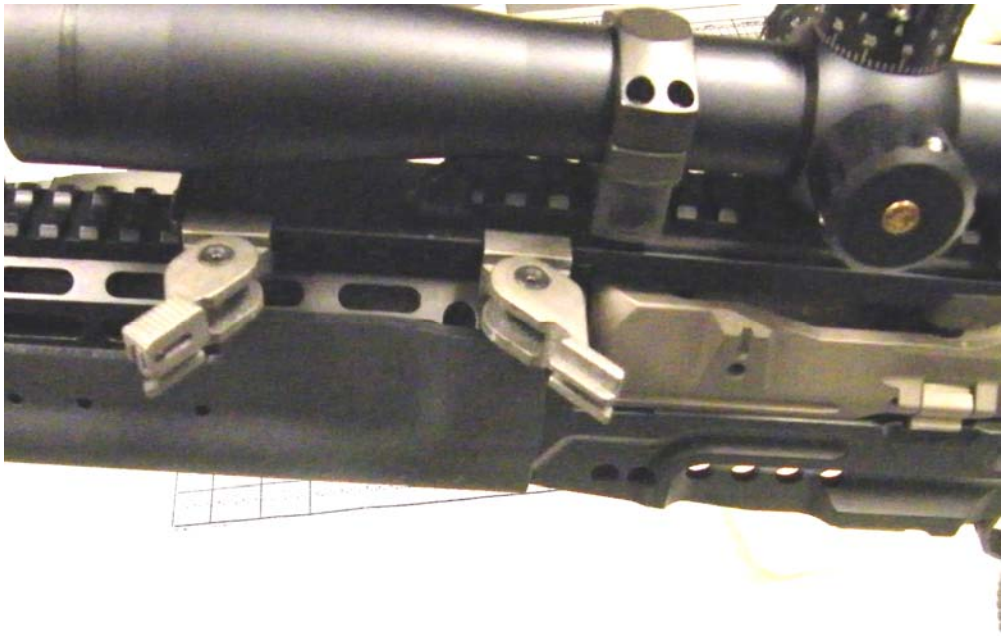
To remove the cantilever base, push the lock forward towards the muzzle on the forward lever.



Once the lock has been disengaged, pull both levers out away from the base to unlock the base from the forward rail. This may require some force or the loosening of the screws on the throw levers using a 3mm allen head wrench.

CAUTION

Removal of the cantilever base will require a re-zero of the weapon.



With the levers released, lift the rail and scope up and off the forward rail.

You are now free to use the iron sights as a backup sighting system.

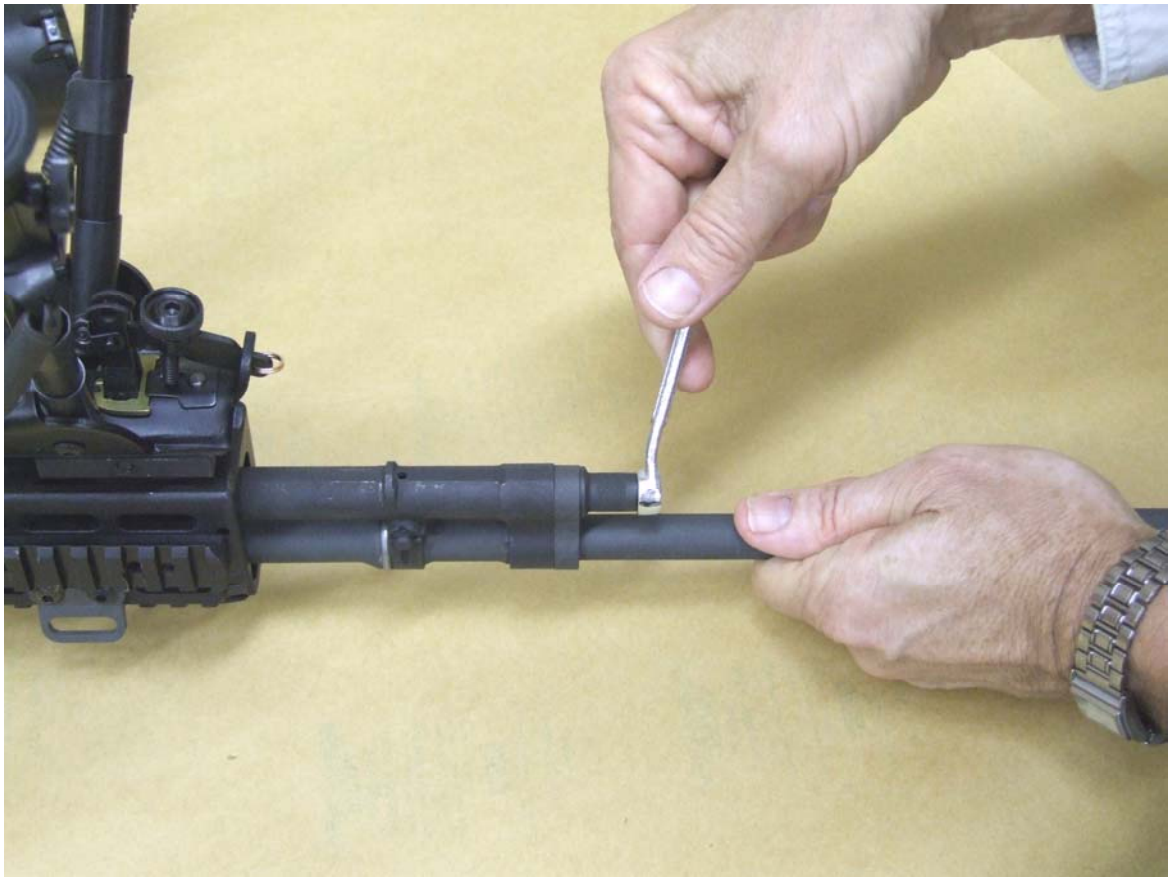
NOTE

Even with iron sights it is still possible to engage and defeat targets to and in excess of 600 yards.

OPERATOR MAINTENANCE AND CLEANING OF THE M14 EBR-RI

Operator disassembly of the M14 EBR is limited to cleaning of the external part of the stock and weapon and disassembly of the gas system and cleaning of the gas piston assembly. The M14 barreled action should not be removed from the stock at the operator level. Any maintenance or cleaning that requires the barreled action to be removed from the stock should be done only by a 45B level armorer.

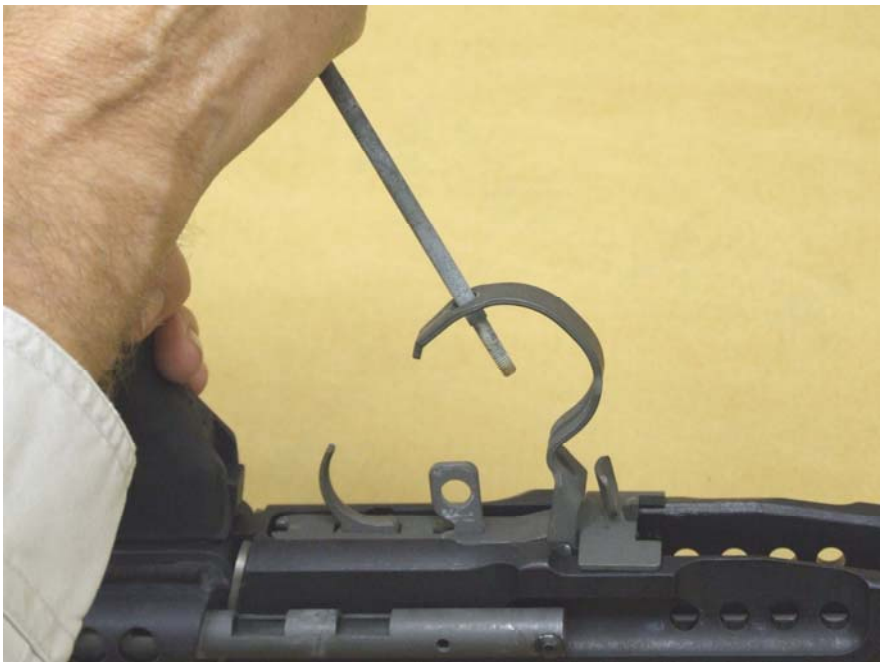
Cleaning of the gas system is accomplished by the removal of the gas plug nut using a 3/18 inch wrench, or the M14 combination tool.



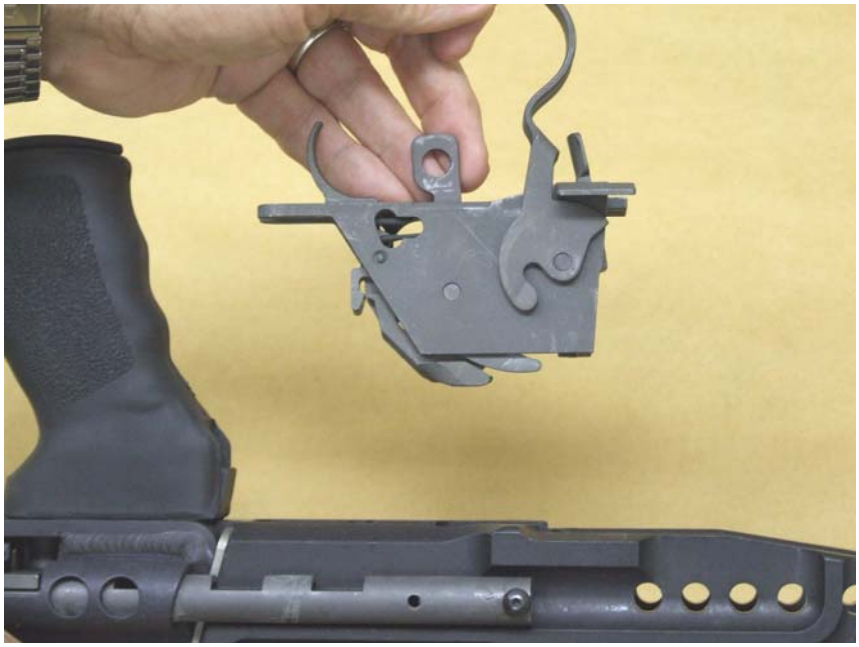
Remove the gas piston itself and remove all carbon build-up.

The carbon can be removed using the reamer on the M14 EBR combo tool as follows:

Remove the trigger assembly by pulling out on the trigger guard and rotating it to the outward position.



Once the trigger guard has been rotated to this position, pull upward on the assembly (as shown below) and lift to remove from the stock. It can now be cleaned and lubed.



Reassembly is in the reverse order that this was accomplished and this is as far as the operator is authorized to disassemble the EBR.

NOTE

From this point on, all maintenance procedures will be accomplished by the 45B trained armorer.

Removal of the M14 barreled action from the EBR stock system.

Remove 6 each, 5/32 inch allen head screws from the top cover / rail assembly and lift the top rail off the stock.

With the top cover / rail removed, turn the rifle over and remove the two 5/32 inch allen head screws that hold the forward hand guard to the lower rail.

CAUTION

The screws that hold the op rod guide on and the screws that hold the forward hand grip on **CANNOT** be interchanged. The screws that hold the op rod guide are NF (National Fine). The screws that hold the forward hand grip on are NC (National Corse). If intermixed, you can damage the stock to the point that it will have to be sent back to Rock Island for repair / replacement.

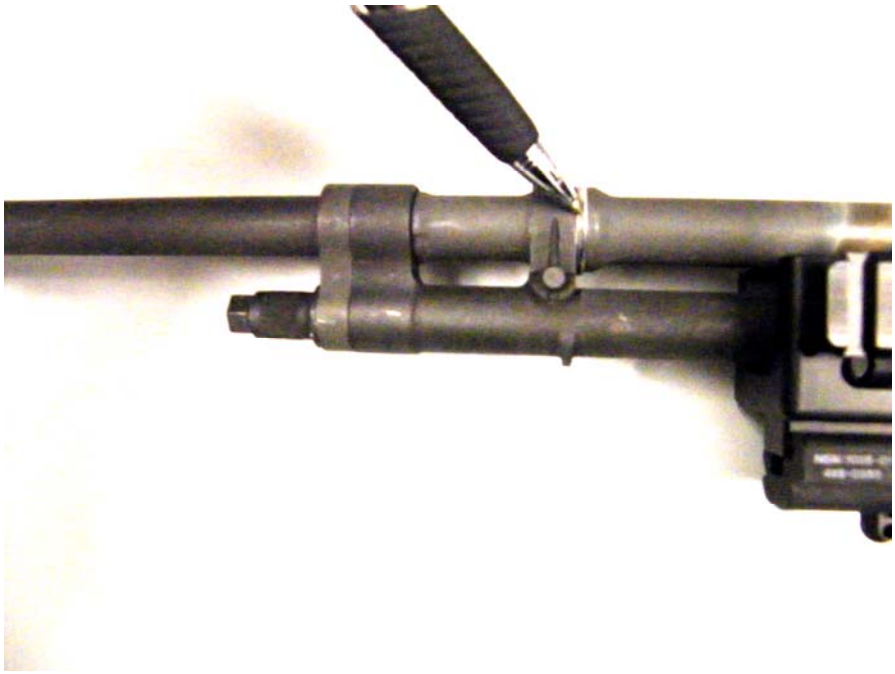
Next, remove the three 5/32 inch allen head screws that hold the operating rod guide to the EBR chassis system. There is one screw on the bottom and one on each side of the EBR chassis system.

Some force may be required to remove the barreled action from the EBR chassis. To do this insert a brass drift into the trigger well and lightly tap the barreled action to release it from the stock chassis.

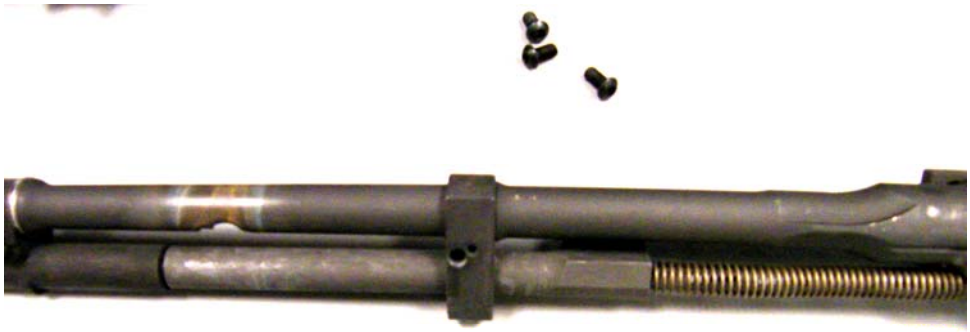
The M14 barreled action has now been separated from the EBR chassis and can be repaired IAW with TM 9-1005-223-20 or 34 as required.

Re-installation of the M14 into the EBR chassis is simple, but there are several things that have to be done to ensure the weapon will shoot accurately.

Only an M14 barreled action that has been properly prepared should be installed into the EBR chassis. This can be determined by the fact that the barrel band has been removed and there are shims, or, on later models, a crush washer between the barrel and gas system as in the picture below:



Verify that the Sage unique op rod guide is properly positioned on the barreled action.



NOTE

Some force may be required to properly seat the action in the stock. This should be accomplished by the use of a soft face mallet to seat the action far enough for the trigger group to be re-installed and full lock-up.

Place the barreled action into the Sage stock.

NOTE

Three allen head screws are NF (National Fine) thread. **DO NOT** intermix them with the two screws that hold on the front hand guard.

Align the three 5/32 inch screws and re-install them in the op rod guide.

Next, re-install the forward hand guard using the two 5/32 inch NC allen head screws.

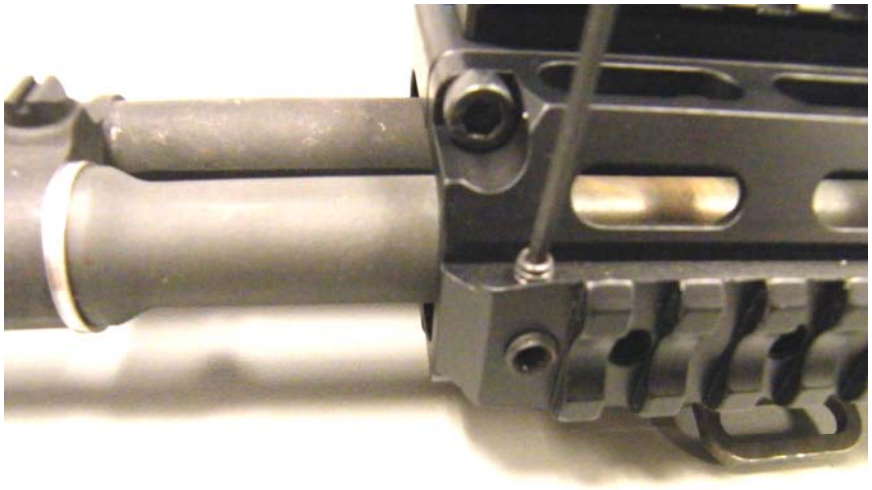
NOTE

DO NOT intermix these screws with the screws that hold the op rod guide in place as they are course thread NC.

Re-install the top cover / rail assembly using the 6 5/32 inch allen head screws.

Next comes one of the two most important steps to properly set up the M14 EBR-RI and ensure that it will meet the accuracy goals of one MOA or less.

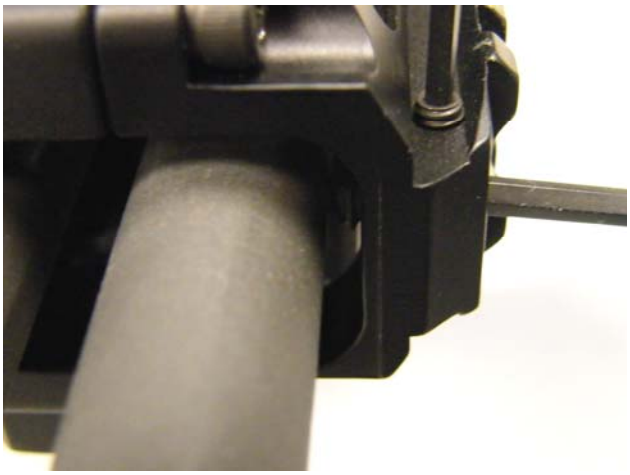
Using a 5/64 inch allen, loosen up the locking screw on the right front of the stock.



CAUTION

Moving this screw too far can seriously affect the accuracy of this weapon. It should just come in contact with the barrel but not enough to move the barrel itself.

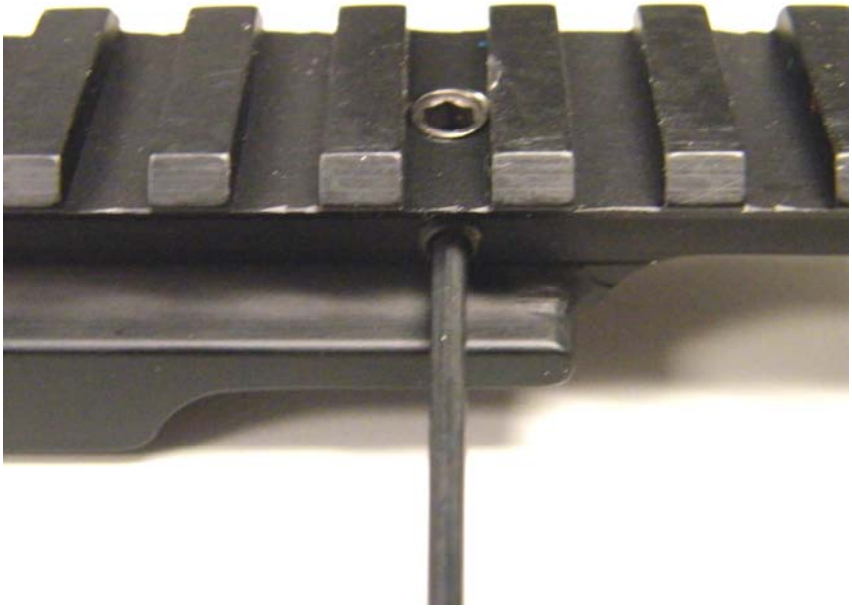
Using a 3mm allen, move the barrel control screw down until it just comes in contact with the barrel.



When contact is made, lock the screw in position with the 5/64 inch locking screw on the right side of the stock. The purpose of this screw is to control barrel whip during firing and is one of the things that enhances the accuracy of this system. If this step is not done correctly, the weapon will not achieve its maximum accuracy potential.

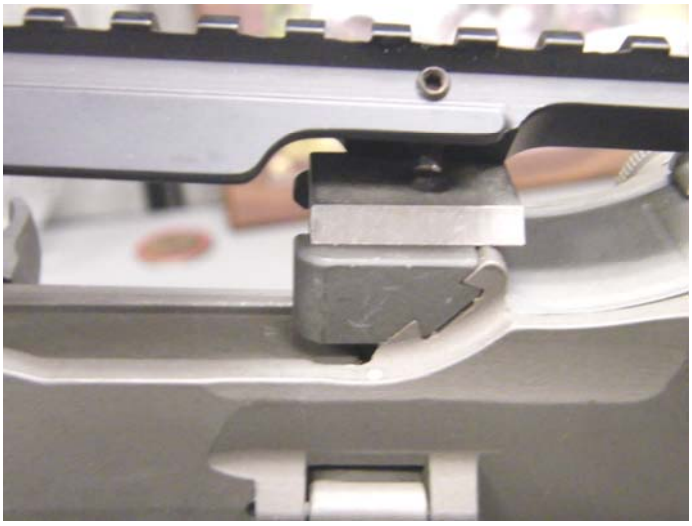
Proper setup of the Sage cantilever base is shown as follows:

To get the base ready for installation on the weapon, unlock the 5/64 inch allen head locking screw on the left side of the cantilever base assembly.



Use the 3mm allen head wrench to adjust the dog point rear support screw down to assist in the proper location of the mount to the rear base support.

Install mount to base by locating rear support screw into hole in mount base.

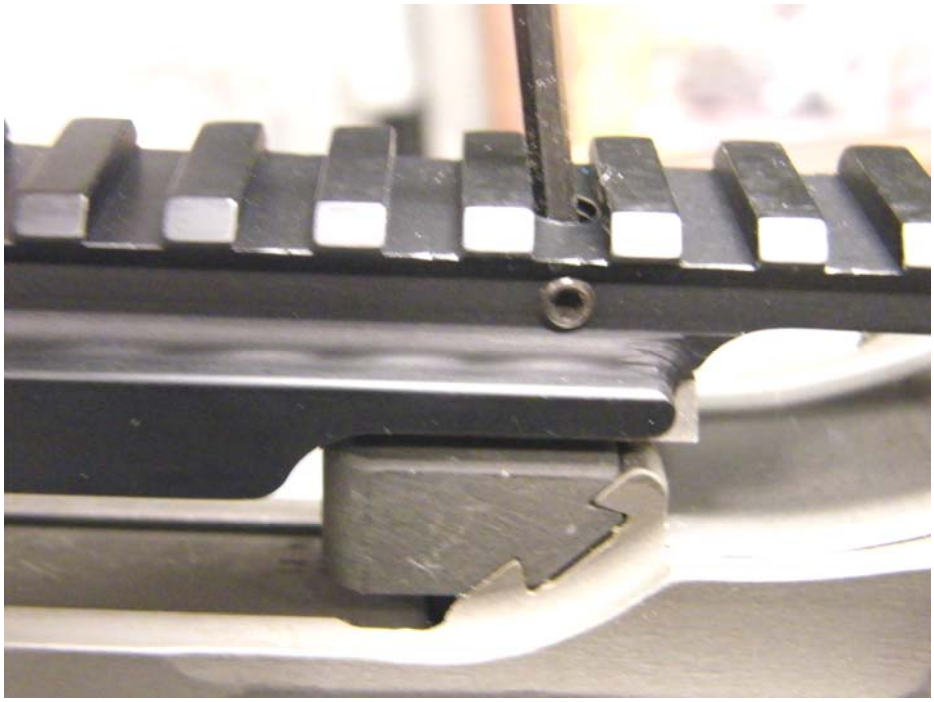


Once the dog point screw positively locates the cantilever base in the proper position, lock the throw levers.

NOTE

You may have to use the 3mm allen head wrench to adjust the throw levers to exert the proper amount of tension. Continue to tighten and close the levers until it becomes very difficult to close the levers but it is still possible.

Once the throw levers have been closed, use the 3mm allen head wrench to turn the rear base support screw down until the rear of the cantilever base begins to rise. When the base starts to rise, turn ½ inch more and lock the 5/64 inch locking screw on the left side of the mount.



You may now mount the scope to the cantilever base and send the rifle out to be zeroed.

WARNING

DO NOT fire corroded or dented cartridges, cartridges with loose bullets, or any other defective rounds detected by visual inspection.

DO NOT fire if water is present in the barrel.

Always use serviceable and authorized ammunition.

Always keep your finger away from the trigger unless you intend to fire.

Rifle will fire if the safety selector lever is forward in the fire position on your weapon.

Weapons are to be loaded, fire handled, and maintained in the manner prescribed by the weapon's basic operator's manual and FM and within the bounds of local SOP's and regulations.

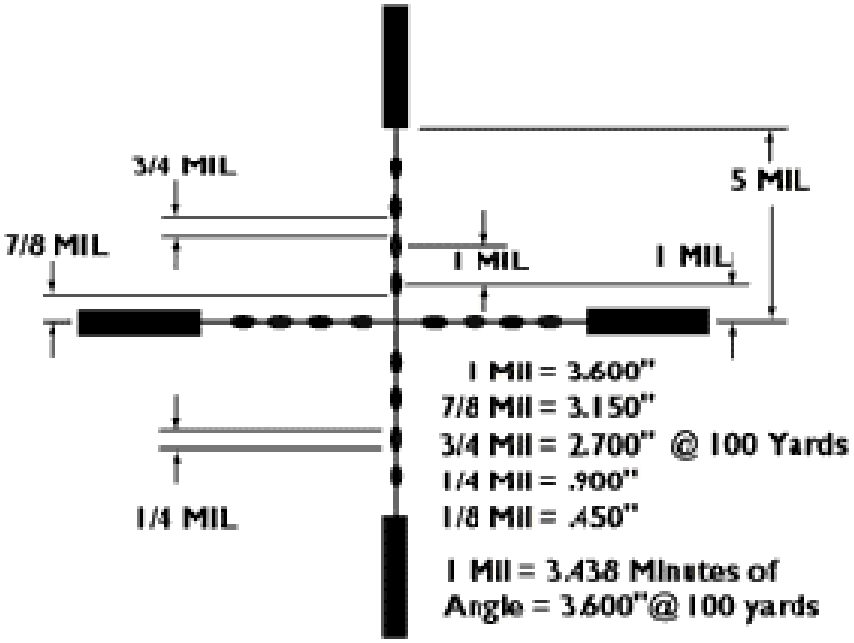
AMMUNITION:

Only the following U.S. approved 7.62mm ammunition may be fired:

DODIC AA11, M118 Long Range (7.62 x 51mm) (Preferred)
DODIC AA04, M993 Armor Piercing
DODIC AIII, M82 Blank Cartridge
DODIC A122, M80 Ball Cartridge
DODIC A136, M118 Special Ball

The Mil-Dot Reticle

This reticle was developed in the late 1970s to help U.S. Marine snipers estimate distances, and is now standard for all military branches. The space between dot centers subtends one milliradian(mil) - hence the name mil-dot. Contrary to popular belief it does not stand for "military dot". One mil. subtends 3.6 inches at 100 yards or 36 inches at 1,000 yards. To use this system effectively, you must know the size of the target. For instance, most people are an average of 6 feet tall or 2 yards. The formula used for determining range to the target is (size of target x 1000 divided by number of mils the target covers).



Height of target (yards) X 1,000 = Range (yards)
Height of target (mils)

You can do these calculations with a calculator or use a reference table like the ones listed below. But remember that your answer is only as accurate as the numbers you plug into the formula. An error of just a 1/4 mil will cause an error in target range. Also, an error in estimating the size of your target will cause an error in target range.

The top line on the table represents the size of the target as measured in feet or inches. The second line represents the conversion of the foot measurements to yards. The left column shows the mil measurements to the nearest 1/2 mil. The mil scale can be split to the nearest 1/8 mil for a more accurate range measurement. To use the table follow the instructions on the next page.

1. Estimate height of target and locate across the top.

2. Measure height of target in mils and locate down the side.

3. Move down from the top and right from the side to find the range in yards.

TABLE OF MILS FOR OBJECTS IN FEET						
FEET		3	4	5	6	7
YARDS		1	1.3	1.7	2	2.3
MIL	2	500	650	850	1000	1150
MIL	2.5	400	520	680	800	920
MIL	3	333	425	566	665	766
MIL	3.5	285	371	486	571	657
MIL	4	250	325	425	500	575
MIL	4.5	222	289	370	444	511
MIL	5	200	260	340	400	460
MIL	5.5	182	236	309	362	418
MIL	6	167	217	283	334	383
MIL	6.5	154	200	262	308	354
MIL	7	143	186	243	286	329
MIL	7.5	133	173	227	266	307
MIL	8	125	163	213	250	288
MIL	8.5	118	153	200	234	271
MIL	9	111	144	189	222	256
MIL	9.5	105	137	178	210	242
MIL	10	100	130	170	200	230

Range Estimating with the Mil-Dot Reticle

Dots are spaced in one mil (milliradian) increments on the crosshair. Using the mil formula, a table can be created like the ones above that is based on the size of the object being targeted. Just look through the scope, bracket the object between dots, and refer to the table above for an estimated distance to target. The radian is a unit less measure which is equivalent, in use, to degrees. It tells you how far around a circle you have gone. 2 PI radians = 360 degrees. Using 3.14 as the value of PI, 6.28 radians take you all the way around a circle. Using a Cartesian coordinate system, you can use "x"- and "y"- values to define any point on the plane. Radians are used in a coordinate system called "polar coordinates." A point on the plane is defined, in the polar coordinate system, using the radian and the radius. The radian defines the amount of rotation and the radius gives the distance from the origin (in a negative or positive direction).

The radian is another measurement of rotation (the degree/minute/second-system being the first). This is the system used in the mil-dot reticle. We use the same equation that we used before, but instead of your calculator being in "degree" mode, switch it to "radian" mode. One milliradian = 1/1000 (.001) radians. So, type .001 into your calculator and hit the "tangent" button. Then multiply this by "distance to the target." Finally, multiply this by 36 to get inches subtended at the given distance. With the calculator in "radian" mode, type the following:

tangent(.001)*100*36 = 3.6000012"

So, one milliradian is just over 3.6 inches at 100 yards. If we extrapolate, two milliradians equal about 6 feet at one-thousand yards. The mil-dot reticle was designed around the measurement unit of the milliradian. The dots, themselves, were designed with this in mind and the spacing of the dots was also based upon the milliradian. This allows the shooter to calculate the distance to an object of known height or width. Height of the target in yards, divided by the height of the target in milliradians, multiplied by 1000, equals the distance to the target in yards. For example, take a 6-foot-tall man (2 yards). Let's say that the top of his head lines up with one dot and his feet line up four dots down. So: (2/4)*1000 = 500 yards away. This same technique can be used to estimate lead on a moving target or to compensate for deflection on a windy day. The distance from the center of one dot to the center of the next dot is 1 milliradian. We are told (by Leupold) that the length of a dot on one of their reticles is 1/4 milliradian or 3/4 MOA (given this much information, one can determine that the distance between dots is 3/4 milliradian.).* I use the term "length" because the mil-dot is not round in all cases. It is oblong in some scopes and round in others (tasco). The width of each dot is an arbitrary distance and is not used for any practical purpose. Like a duplex reticle, the mil-dot reticle is thicker towards the edges and uses thin lines in the middle where the dots are located and the crosshairs cross. The distance between the opposite thick portions is 10 milliradians on Leupold scopes.

***NOTE:** 1/4 milliradian = .9" and 3/4 MOA = .785", so, obviously, a mil-dot cannot be both 1/4 milliradian and 3/4 MOA. The maker of the mil-dot reticles for Leupold explains: The dots on their mil-dot reticles are 1/4 mil. They are not 3/4 MOA. Apparently, Leupold just figured that more shooters understand MOA than milliradians, so they just gave a figure (in MOA) that was close, but not super precise.

To use a mil-dot reticle effectively, all one needs to remember is that the distance between dot centers is 36" at 1000 yards. This lets you determine the range of a target of known size. At that point, you can dial the scope in for proper elevation OR use the dots to hold over the proper amount. The dots on the horizontal crosshair can be used to lead a target (if you know the range to the target, then you'll know the distance between dots, and thus the distance to lead) or to compensate for deflection.

Minute of Angle (MOA)

The term "minute of angle" (MOA) is used regularly by target shooters at the range, but is probably understood, thoroughly, by few (the same goes for mil-dots). Defined loosely, one MOA = 1" @ 100 yards; so, if you shot your rifle 5 times into a 100 yard target and every shot went into a one-inch circle, you had drawn on the paper, then your rifle could be said to shoot 1 MOA. Likewise, if every shot goes into a two-inch circle at 200 yards, then you're shooting 1 MOA. A 10-inch group at 500 yards would be 2 MOA.

Now, for the fun part. There are 360 degrees in a circle. Each degree can be broken down further into minutes. There are 60 minutes in a degree. Likewise, there are 60 seconds in a minute. Now, to figure out the distance subtended by 1 minute at any particular distance, we need merely to plug those two values into a simple trigonometric equation. The tangent function fits the bill nicely. Here's the equation:

tan(angle) = distance subtended/distance to the target (units must be consistent; e.g., 1/36 of a yard [1"] divided by 100 yards)

Now, we know the angle (1 minute or 1/60 of a degree), and we know the distance to the target (100 yards), but we need to figure out the actual distance subtended at the target (i.e., is 1 MOA actually 1" @ 100 yards?). What we need to do is solve for "distance subtended." Here's our final equation:

tan(angle)*distance to the target = distance subtended

Make sure your calculator is in "degree" mode (as opposed to "radian" or "gradian") and type in 1/60 (for degrees) and hit the "tangent" button. Then multiply that by 100 yards. This should give you the distance (in yards) subtended at 100 yards. Multiply this by 36 to get inches. The answer should be:

1.047197580733"

This is just a hair over the commonly quoted "one inch." At 1000 yards, this would be almost 10 1/2 inches. Apparently, it is just a coincidence that 1 MOA happens to be REALLY close to 1" @ 100 yards. It is, however, quite convenient.